



# ORAN Opportunities are opening up



MOBILE EXPERTS

© 2019 Mobile Experts

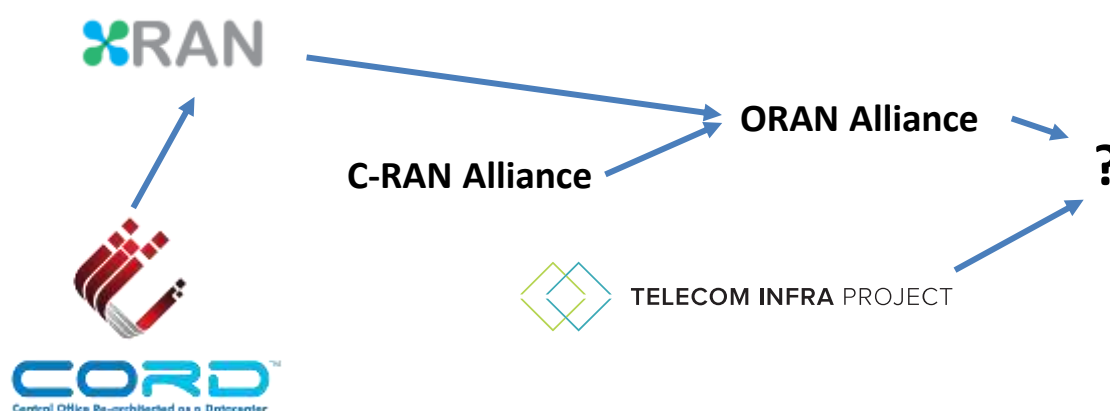
All Rights Reserved

November 2019

## Background

Open standards in Radio Access Networks have been an elusive dream for operators over the past 20 years. The old CPRI and OBSAI organizations failed to achieve interoperability, mainly because the major OEMs sidetracked these groups and the standards were never complete enough to create an open interface.

Recent efforts have been more successful, as operators involved with CORD contributed their work to the xRAN Forum. Then, xRAN Forum merged with the C-RAN Alliance, forming the ORAN Alliance. The Facebook-sponsored Telecom Infra Project is also contributing here but has no intention of developing its own specs. Separately, the CPRI Alliance is developing specific standards for the fronthaul/midhaul protocols between the RRH and the BBU.



Source: Mobile Experts

**Figure 1. Convergence of Multiple Open RAN organizations**

Confused? It's a chaotic mess. But out of the chaos, for the past six months we have seen cooperation between all of the various organizations, so that CPRI Alliance will supply physical specifications, ORAN Alliance will govern the management plane specs, synchronization, and other key details. TIP has agreed not to develop their own specs, and will focus on reference designs. In short, everyone is working on different aspects of the system to reduce confusion.

Initiative	Launch Date	Goal	Status
Telecom Infra Project (TIP)	February 2016	Multiple goals	OpenRAN group led by Vodafone/Intel to develop APIs, orchestration...then test FPGA-enhanced x86 servers
xRAN Forum	October 2016	Open RRH/BBU interface	Merged with ORAN Alliance, February 2018
C-RAN Alliance	Nov 2016	Virtualization and open interfaces	Merged with xRAN Forum to form ORAN Alliance, February 2018
Open RAN Alliance	February 2018	Open RRH/BBU interface	Growing support of operators. Released open fronthaul spec in April 2018
Open vRAN Initiative (Cisco)	February 2018	Open interfaces	Coordinating with ORAN Alliance
NGMN		Fronthaul architecture	Released vo.6.5 framework in May 2017
eCPRI	Roughly 2016, work within CPRI Alliance	Interface Specification	Released V2.0 to support CPRI over Ethernet (7.0), May 2019

Source: Mobile Experts. NOTE: Focus here is on RU-DU interface

**Figure 2. Details of multiple Open RAN organizations**

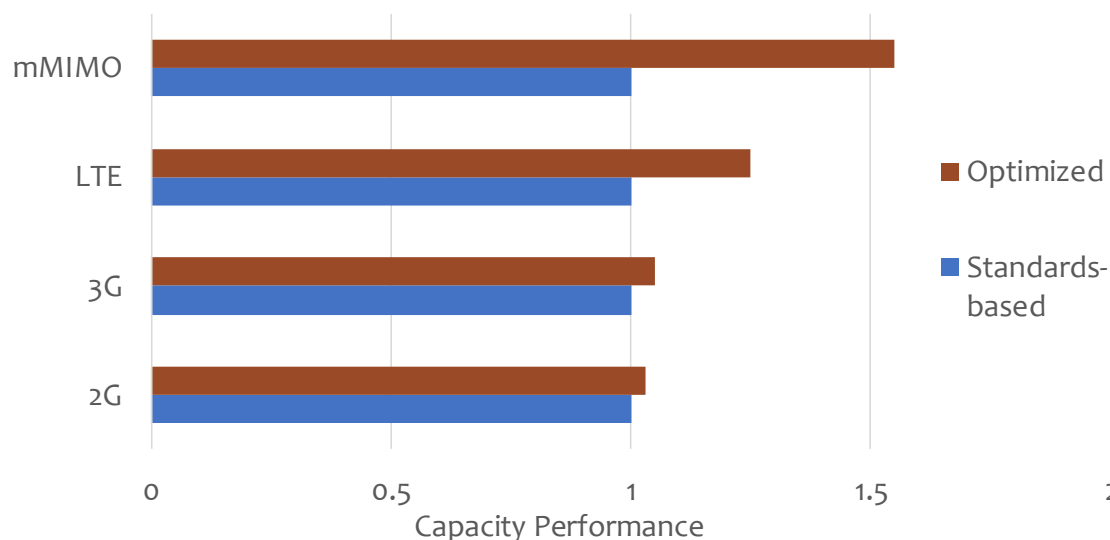
Despite these efforts, it will remain confusing because multiple variations on the RU/DU baseband split will be used in the market. The “Option 7.2” split is one variation but other variations with different levels of baseband processing in the RU will be required to support different bandwidth/latency/cost tradeoffs. In the end, we expect the collection of standards to provide interoperability, but users will need to be careful to choose the right options.

### Outdoor use of ORAN

In early 2019, we predicted low adoption of ORAN in outdoor mobile network, except for third-world countries or rural areas where capacity is not important. We stand by that prediction.

Here's why we believe strongly that capacity-challenged outdoor networks will not use ORAN in the near term: The major OEMs use dozens, or even hundreds, of proprietary algorithms in their outdoor mobile networks to optimize performance. These proprietary algorithms work on top of the basic 3GPP-defined functionality, improving things like handovers, power control, beamforming, and scheduling. Previous attempts to use one vendor's RRH with another vendor's BBU have resulted in low capacity performance, because the proprietary techniques require sensors or other hardware to be present for the OEM software to function.

Based on interviews with operators and OEMs, we believe that proprietary algorithms give LTE a 25% boost in capacity, and massive MIMO/beamformed systems are likely to get more than 50% capacity improvement from special algorithms.



**Figure 3. Measured Benefit of Coordination between Radios**

So, although ORAN standards will enable two hardware vendors to work together, the loss of performance will be unacceptable for any operator that has capacity challenges.

### Indoor use of ORAN

The indoor market has very different considerations. Capacity is not the primary factor in the minds of building owners and enterprises...many of them are looking for simple coverage in their building, using the simplest possible product.

The major OEMs have been addressing the indoor market for the past six years, with Radio Dots and LampSite and small cells. They've had some success, but from a strategic point of view these efforts have been hindered by the mobile operators. The operators aren't comfortable with millions of small cells on their spectrum, raising the noise floor and providing an unknown quality of service to end customers. So the operators have been refusing to support many indoor small cell implementations, even when the building owner is willing to pay.

The operator has been able to control the situation for the past six years, because they controlled the spectrum. But starting in 2019, new private spectrum is available that allows the building owner to move away from operator-controlled spectrum.

The key here is that in the previous model, operators had two ways to resist:

1. Indoor small cells can be perceived as creating interference for the outdoor network. This point is debated often, and LTE provides a way to avoid the interference. But operators point out that any transmitter in the band raises the overall noise floor, which they perceive as a limit on capacity. By refusing permission to use their spectrum, the operators limit the use of indoor small cells by enterprises.
2. Any handset that requests access inside a building today needs to be validated by checking its SIM credentials on the mobile operator's core network. So the operator has to be involved to authenticate the user.

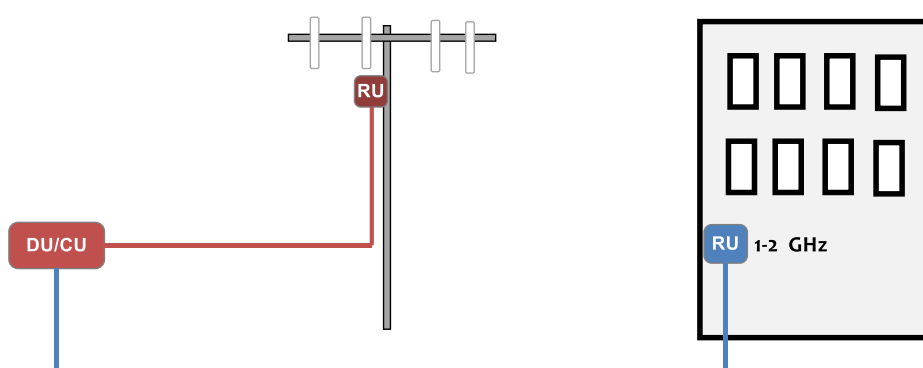
Recent developments address both of these conditions.

1. New spectrum such as the CBRS spectrum in the USA and the 3.7 GHz spectrum in Germany give the enterprise its own licensed spectrum. The mobile operator cannot complain about any dubious claims of interference.
2. Dual-SIM and eSIM devices are coming to market, so that enterprises can now buy devices for their users that authenticate on their own core network, independent of any operators.
3. Neutral hosts are also working out arrangements with mobile operators to manage indoor networks, meeting certain basic standards for quality of service. Assuming that the operators trust neutral hosts like Crown Castle to manage service quality, they may open up access to their core network authentication for key in-building projects. This will entail practically zero cost for the operator, and will offload their outdoor network so the ROI is compelling. This business model all comes down to the level of trust in the neutral host.

## The architecture

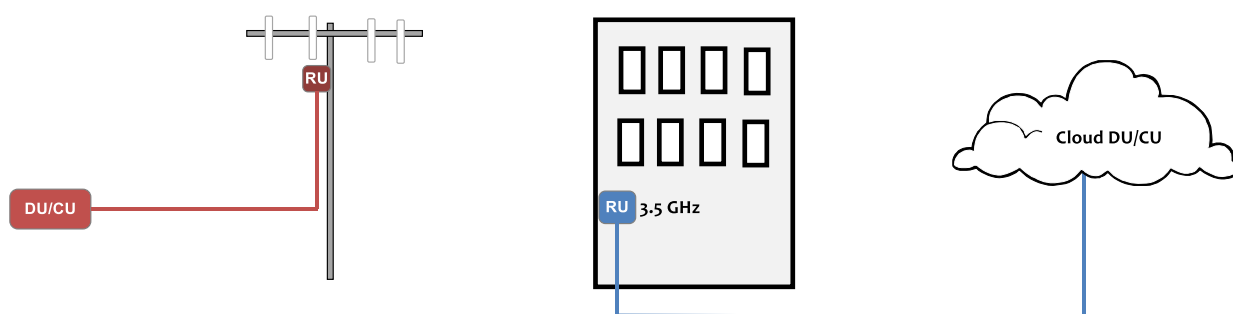
The indoor market has very different considerations. Capacity is not the primary factor in the minds

There are two ways that the ORAN radio units can be connected: an indoor radio unit can connect directly to the operator's existing baseband processing unit (as shown in Figure 4a), or the radio can connect to baseband processing located in the Cloud and supported by a third-party RAN software vendor. (Figure 4b)



Source: Mobile Experts Blue represents ownership by the enterprise; red represents ownership by the operator

**Figure 4a** Connecting the RU for indoor mobile operator coverage



Source: Mobile Experts Blue represents ownership by the enterprise; red represents ownership by the operator

**Figure 4b.** Connecting the RU for coverage independent of the operator

## The supply chain is getting stronger

Dozens of companies are lining up to support ORAN hardware and software, and the trials are mature now in proving that it works. All of the required pieces are coming into place for basic broadband coverage in a building.

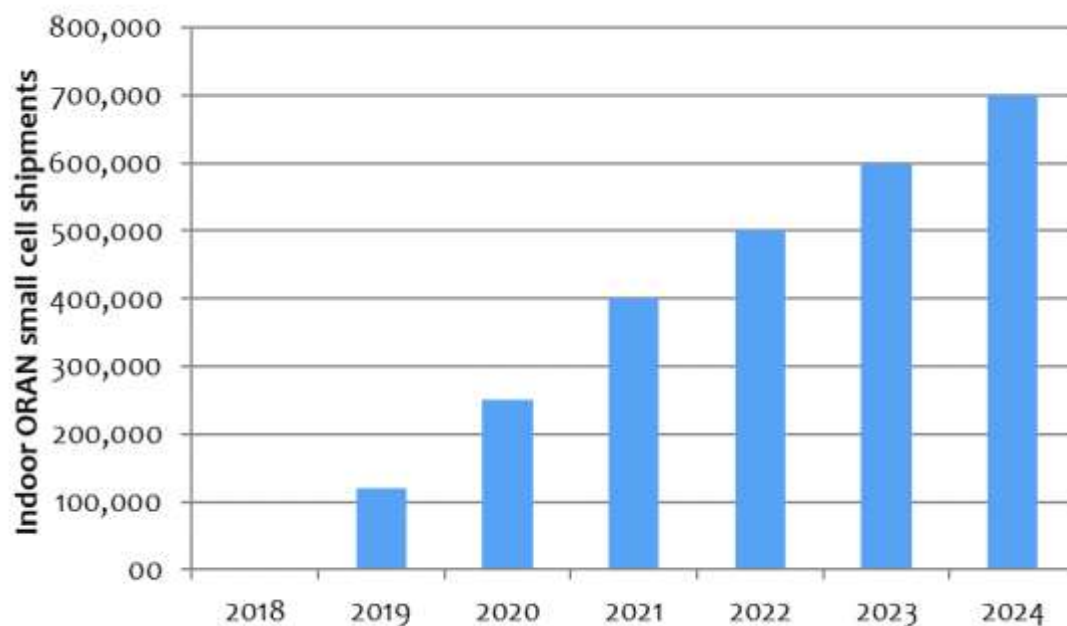
The greatest variety comes in the radio markets. Different bands, power levels, MIMO levels, antenna steering configurations, and other factors create a rich field for specialty RRH units, and several small players have been itching to get into the market.

<b>Software Vendors</b>	<b>RRH Vendors</b>	<b>BBU Vendors</b>	<b>Server OEMs</b>
Altiosstar	AceAxis	Ericsson	Dell
Amarisoft	Baicells	Huawei	HPE
ASOCS	Benetel	Nokia	Lenovo
Mavenir	Blue Danube	Samsung	SuperMicro
Phluido	Commscope	ZTE	Others
	Datang		
	Ericsson		
	Fujitsu		
	Huawei		
	KMW		
	MTI		
	NEC		
	Nokia		
	Parallel Wireless		
	Samsung		
	Tecore Networks		
	ZTE		

Source: Mobile Experts

**Figure 5 Vendors supporting the ORAN market**

So, we have demand from enterprises and possibly from operators. We have a supply chain that is ready to go and the trials are looking good for in-building low-density applications. So it's time for Mobile Experts to do our crystal-ball thing and publish a forecast.



Source: Mobile Experts

**Figure 6. Indoor ORAN based radio node shipments**

Our view is that the indoor DAS/small cell market has been dominated by the operators in the past, even in cases where the enterprise is paying for the wireless kit. But the new market conditions that come along with ORAN and private spectrum will open up an opportunity for at least 500,000 indoor radio nodes to be deployed annually. Over a longer time period, it could be much larger. Heck, the Enterprise Wi-Fi market runs in the several millions of APs per year, and Private LTE could eventually reach that level of popularity.

### Market Upside

The key to market growth between about 500,000 small cells/yr and 5 million small cells/yr will be the integration of Edge Computing and easy-to-use corporate LANs with Private LTE.

Our vision of the desired solution: dual-SIM devices, a Private LTE/5G RAN and core network, and the Edge Computing to manage corporate data, IoT devices, and any on-premises analytics. Anybody that can drop in to an enterprise and set up this kind of network will kick off significant growth in the Private LTE market.